Class- B. Sc. (Ag.) VI-Semester

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"Constraints and Challenges of Conservation Agriculture in India"

Conservation Agriculture technologies involve minimum soil disturbance, permanent soil cover through crop residues or crop covers and crop rotations for achieving higher productivity. CA offers potential solution which not only enhances the productivity but also maintains the environmental safety and ecological sustainability. FAO (2008) asserted that introduction and adoption of CA must overcome a range of constraints that have been highlighted by a number of stakeholders.

Constraints/Problems of Adoption Conservation Agriculture

A mental change of farmers, technicians, extensionists and researchers away from soil degrading tillage operations towards sustainable production systems like Zero/no tillage is necessary to obtain changes in attitudes of farmers. It is probably the most important factor in the adoption of CA. CA is now, considered a route to sustainable agriculture. The following are some important constraints which impede broad scale adoption of CA.

• Technological Constraints

1. Unavailability of high quality or appropriate seeders or equipments/implements especially for small and medium scale farmers.
2. Lack of regular testing and proper maintenance of CA implements.
3. Very limited or no programmes organized for farmers, extension workers and scientists regarding technical knowledge/ training on CA.

Extension Constraints

1. Little or no interest of Agricultural Departments on CA.
2. Lack of extension materials.
3. Lack of technical knowledge about CA on institutional basis.
4. Lack farmers co-operation.
5. Lack of officers skilled in CA practices.

Economic Constraints

1. High cost of CA equipments/implements.

2. Lack of easy loan facilities for farmers.
3. Poor economic condition of marginal and small farmers.

Social Constraints

1. Farmer's mind set of more yield with more tillage.
2. Difficulties in social acceptance of CA.
3. The wide spread use of crop residues for livestock feed and fuel and competition between CA practice and livestock feeding for crop residue.
4. Burning of crop residues: farmers prefer to sow the crop in time by burning the residue. This has become a common feature in the rice-wheat system in north India.

Challenges in Conservation Agriculture

Conservation agriculture as an upcoming paradigm for raising crops will require an innovative system perspective to deal with diverse, flexible and context specific needs of technologies and their management. In the countries like India it is very difficult to change the mindset of the agriculturists who are engaged in conventional agriculture. In our country conservation agriculture is comparatively in early stage and the area under CA is only about 2.0 mh but it is increasing slowly due to various hurdles. Popularization of conservation agriculture is not so easy in India there are so many challenges, some of these are:

(a) Understanding the system

Conservation agriculture systems are much more complex than conventional systems. Site specific knowledge has been the main limitation to the spread of CA system (Derpsch, 2001). Managing these systems efficiently will be highly demanding in terms of understanding of basic processes and component interactions, which decide the whole system performance. For example, surface maintained crop residues act as mulch and therefore, reduce soil water losses through evaporation and maintain a moderate soil temperature regime (Gupta and Jat, 2010). However, at the same time crop residues offer an easily decomposable source of organic matter and could harbour undesirable pest populations or alter the system ecology in some other way. No/Zero-tillage systems will influence depth of penetration and distribution of the root system which, in turn, will influence water and nutrient

uptake and mineral cycling. Thus, the need is to recognize conservation agriculture as a system and develop management strategies.

(b) Building a system and farming system perspective

Integrated approach of a core group of scientists, farmers, extension workers and other stakeholders working in partnership mode will require for promoting new technologies. This is somewhat different than in conventional agricultural Research and Development, the system is to set research priorities and allocate resources within a framework, and little attention is given to build relationships and seek linkages with partners working in complementary fields.

(c) Technological challenges

While the basic principles which form the foundation of conservation agriculture practices, that is, Zero-tillage and surface managed crop residues are well understood, adoption of these practices under varying farming situations is the key challenge. These challenges relate to development, standardization and adoption of farm machinery for seeding with minimum soil disturbance, developing crop harvesting and management systems.

(d) Site specificity

Adapting strategies for conservation agriculture systems will be highly site specific, yet learning across the sites will be a powerful way in understanding why certain technologies or practices are effective in a set of situations and not effective in another set. This learning process will accelerate building a knowledge base for sustainable resource management.

(e) Long-term research perspective

Conservation agriculture practices, e.g. Zero-tillage and surface-maintained crop residues result in resource improvement only gradually, and benefits come about only with time. Indeed in many situations, benefits in terms of yield increase may not come in the early years of evaluating the impact of conservation agriculture practices. Therefore, research in conservation agriculture must have longer term perspectives.

Policy Issues

Conservation agriculture implies a drastic change from traditional agriculture. There is need for policy analysis to understand how CA technologies integrate with other technologies, and how policy instruments and

institutional arrangements promote CA (Raina *et al.*, 2005). CA offers an opportunity for making agriculture more resource – use-efficient, competitive and sustainable. While Research & Development efforts over the past decade have contributed to increasing farmer acceptance of zero tillage for wheat in rice-wheat cropping systems, this has raised a number of institutional, technological, and policy related issues which must be addressed if CA practices are to be adopted in large scale in the region on a sustained basis. The following are some of the important policy considerations for promotion of CA.

• **Scaling up conservation agriculture practices:**

Efforts to adapt the CA principles and technological aspects to suit various agro-ecological, socio-economic and farming systems in the region started a few decades ago. In India much research work on CA has been conducted for more than a decade, mostly at the *Indian Agricultural Research Institute*. However, its percolation to farmers is very limited. Most cases, where changes in favour of CA have occurred, are limited in success. One of the reasons for poor percolation of the technology to the farmers was the past bias or mindset about tillage by the majority of farmers (Hobbs and Govaerts, 2010). In India, efforts are being initiated through a network research project for on-farm evaluation and demonstration of CA technology for its promotion.

• **Shift in focus from food security to livelihood security:**

The "food security" policy of India based on cereal production must now replace a well-articulated policy goal for livelihood security. This will help the diversification of dominant rice-wheat cropping systems (occupying about 10.5 million ha) in the Indo-Gangetic Plains, the cultivation of which in conventional tillage practice has overexploited the natural resources in the region. The nature of cropping patterns and the extent of crop diversification are influenced by policy interventions.

• **CA offers opportunities for diversified cropping systems in different agro-eco-regions.**

Developing, improving, standardizing equipment for seeding, fertilizer placement and harvesting ensuring minimum soil disturbance in residue management for different edaphic conditions will be key to success of CA. For many situations for example, in hilly tracts, for small land holders bullock drawn equipment will have greater relevance. In these situations, the

subsidy support from national or local government to firms for developing low cost machines will help in the promotion of CA technologies.

• CA technologies bring about significant changes in the plant growing micro-environment.

The requirement of plant types suited to the new environment, and to meet specific mechanization needs could be different. There is a need to develop complementary crop improvement programmes, aimed at developing cultivars which are better suitable to new systems.

• Documentation and Monitoring.

There is a need for generating a good resource database with agencies involved complementing each other's' work. Besides resources, systematic monitoring of the socio-economic, environmental and institutional changes should become an integral part of the major projects on CA.

• Policy support for capacity building by organizing training on CA is needed.

Availability of trained human resources at ground level is one of the major limiting factors in adoption of CA. Training on CA should be supported at all levels.

•Institutionalize CA:

CA has to be mainstreamed in relevant ministries, departments or institutions and supported by adequate provision of material, human and financial resources to ensure that farmers receive effective and timely support from well trained and motivated extension staff. Institutionalizing CA into relevant government ministries and departments and regional institutions is required for sustainability of the technology. CA could be integrated into interventions such as seed, fertilizer and tillage and draft power support programmes as a way of further enhancing productivity.

• Support for the adaptation and validation of CA technologies in local environments:

Adaptive research is required to tailor CA principles and practices to local conditions. This should be done in collaboration with local communities and other stakeholders. The resource poor and small holder farmers in India do not have economic access to new seeds, herbicides and seeding machineries etc. (Sharma *et al.*, 2012). This calls for policy frame work to make easily available critical inputs.

• **Support the development of CA equipment and ensure its availability:**

In India, significant efforts have been made in developing, refining and promoting the second generation zero-till multi-crop planters, but quality control assurance on standards and their availability at the local level with after-sale services and spare parts is still an issue. The new machineries, viz. happy seeder, turbo seeder, laser land leveler etc. are found useful for CA practices, but these machines are more suitable for rich and medium to large farmers groups. They need smaller versions of these machines which needs policy support for manufacturing at the local level.

• **Promote payments for environmental services (PES) and fines for faulty practices:**

Continuous rice-wheat cropping with intensive tillage has resulted in over exploitation of resources, a decline of productivity, loss of soil fertility and biodiversity, and a decline of resource use efficiency in the Indo-Gangetic plains of India. Additionally, burning of huge quantities of crop residues has adverse environmental impacts. Incorporation of crop residues is being considered as an alternative to burning and alters the soil environment, which in turn influences the microbial population and activity in the soil and subsequent nutrient transformations (Yadvinder-Singh *et al.*, 2005). There is a need for a strong policy intervention for prohibiting such an unscientific practice by imposing a fine.

• **Credit and subsidy:**

The other important thing for successful adoption of CA is the need to provide credit to farmers to buy the equipment, machinery, and inputs through banks and credit agencies at reasonable interest rates. At the same time government need to provide a subsidy for the purchase of such equipment by farmers.

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